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LIFE HISTORY STUDIES ON MEXICAN BUTTERFLIES

II. EARLY STAGES OF *ANATOLE ROSSI* A NEW MYRMECOPHILOUS METALMARK

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During the fall of 1962 and the summer of 1963, I collected a new species of metalmark on the slopes of Volcán Santa Marta (Sierra Tuxtla, Veracruz, Mexico). This species, *Anatole rossi* Clench, is described in this same issue (Clench, 1964). Descriptions of the larva with brief observations on its ecology and ethology are given here; the intimate association between this larva and ants of the species *Camponotus abdominalis* Fabr. (Formicidae: Formicinae) will be described at a later date.

Terminology is based on that of Fracker (1915) and Peterson (1948).

Measurements and color descriptions are based on living material (larval measurements are based on individuals in a state of rest).

Drawings of the larval lateral tubercles and "honey glands" as well as the pupal gland (figs. 6 & 7) were made from both gross dissections of and longitudinal cross sections through larvae and pupae. All longitudinal sections were dehydrated in ethyl alcohol and cleared in xylene. The larval metathoracic and abdominal sections were imbedded in tissuemat and sectioned at 10 microns. The metathoracic section was stained with Grote's hematoxylin and eosin Y and the larval abdominal section was stained with Delafield's hematoxylin and eosin Y. The pupal metathoracic section was imbedded in tissuemat, sectioned at 20 microns, and stained with Delafield's hematoxylin and eosin Y.

All drawings are by the author.

ACKNOWLEDGEMENTS

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EGG: Fig. 3F. (Measurements and duration are based on 21 specimens.) Dimensions-height, 0.4-0.5 mm.; width, 0.6-0.7 mm. Duration of stage, 8-9 days.

Dorso-ventrally flattened, slightly concave on both the dorsal and ventral surfaces. Entire outer surface (except the region surrounding the micropyle) with fine, elevated, hexagonal reticulations; small villus-like processes protruding from the corners of all hexagons.

Color milky light green, acquiring a slight yellowish tinge two days before the larva emerges.

Oviposition is on the undersurfaces of the new leaves of Croton repens Schlecht. (Euphorbiaceae), a bush reaching a maximum height of 2 to 2 1/2 feet and found commonly in the open pine forest on the leeward slope of Volcan Santa Marta. Eggs are deposited singly, usually one per plant, and often (but not exclusively) on leaf veins. Females appear to be selective in regards to oviposition sites: I never have seen any ovipositing on the mature, robust, densly foliate plants which were so common in the area but have noticed that they always choose the very small (usually plants below 7 inches in height), sparsely foliate plants. Perhaps one explanation for this fact is that the new leaves of the mature crotons seem to be much more pubescent than the new leaves of the younger and smaller plants. When these densely pubescent leaves were offered to experimental first, second, and third instar larvae, the larvae experienced difficulty in getting their mouth parts through the hairs in order to feed on the succulent tissues beneath. In fact, they all died, presumably from starvation. Therefore, there seems to be some survival value in the female's avoidance of the more mature plants.

It is interesting to note that Zikan (1953) pictures and describes the egg of Anatole epone (Godt.), which does not correlate well with the egg of A. rossi, and records the food-plant as Croton lundianus Mull.

FIRST INSTAR LARVA: Fig. 1A. (Measurements and duration are based on 15 specimens.) Subsequent to egg hatching- length, 1.4-1.5 mm.; width, 0.2-0.3 mm.; head diameter, 0.32-0.33 mm. Termination of stadium- length, 2.5-2.6 mm.; width, 0.7-0.8 mm. Duration, 4-5 days.

Head (fig. 2D) slightly wider than prothoracic segment; dark brown with fine, finely serrate, tan setae on lower portion; ocelli dark brown.

Body dorso-ventrally compressed with segments extended laterally giving the larva a flattened "scalloped" appearance. Prothoracic segment with a pair of very slight dorso-anterior expansions (rudiment of the hood described below) concolorous with the body. Penultimate segment (the fused ninth and tenth abdominal segments) slightly smaller than the other body segments and appearing button-like (the penultimate segment retains this shape throughout all instars and will not be discussed hereafter). Spiracles elliptical and inconspicuous(prothoracic pair located on the suprapedal lobes).

Paired primary setae (0.1-0.2 mm. in length, stout, white, and simple) on segments in the following arrangements: prothoracic (cervical shield)--1 dorsal-subdorsal, 1 lateral; meso- and metathoracic-- 1 dorsal and 1 subdorsal; first to seventh abdominal-- 2 dorsal (1 anterior, 1 posterior); eighth and ninth abdominal-- 1 dorsal and 1 subdorsal; tenth abdominal-- 1 dorsal; in addition to the above, the first to the ninth abdominal with 1 on the dorso-anterior portions of the lateral segmental expansions and the tenth abdominal with 1 on the median portion of the lateral segmental expansion. Paired secondary setae (approximately 0.8-0.9 mm. in length on the prothoracic segment and approximately 0.3-0.4 mm. in length on all other segments), fine, serrate, and white (fig. 4M) on segments in the following arrangements: prothoracic-- 4 arising from the dorso-anterior projection of the cervical shield (3 of which project fan-like anterior, the fourth projecting slightly laterally), 1 on the lateral expansion and 1 on the suprapedal lobe; mesothoracic to the ninth abdominal-- 3 arising from the lateral expansions and projecting laterally and 1 or 2 on the suprapedal lobes; tenth abdominal-- 3 arising as the above but projecting fan-like posteriorly and 1 or 2 on the suprapedal lobe. Setal maps (fig. 5A) illustrate the above arrangements.

Legs concolorous with the body. Prolegs concolorous with the body and with the crochets arranged in an uniordinal mesoseries; ventral prolegs each with a small fleshy protuberance separating the 4 mesal crochets from the 2 lateral crochets (fig. 4A); anal prolegs each with a similar protuberance but only a mesal mesoseries of 4 crochets present (fig. 4G); prolegs each with 1 or 2 small, simple, white setae arising from the planta.

Body uniform light yellow (turning greenish the day prior to the first molt) with a supraspiracular row of faint black dots on the second to the seventh abdominal segments.

Larvae emerge from the depressed micropyle, leave the egg intact and crawl (still on the undersurface of the leaf) to an angle between two veins (usually between the midrib and its first branch). They then spin a silken mat upon which they rest during the non-feeding periods, alighning themselves with their heads directed inward toward the petiole. Feeding is on the same leaf; larvae consume small bits of tissue from the inner portions of the leaves, the margins hardly ever being eaten. Leaves, therefore, soon acquire a holey appearance and serve as a landmark for the entomologist wishing to secure larvae.

SECOND INSTAR LARVA: Fig. 1B. (Measurements and duration are based on 13 specimens.) Beginning of stadium- length, 2.6-2.7 mm.; width, 0.7-0.8 mm.; head diameter, 0.52-0.53 mm. Termination of stadium- length, 4.0-4.4 mm.; width, 0.9-1.0 mm. Duration, 4-5 days.

Head dark brown with numerous fine, finely serrate, tan setae concentrated on the lower portion; ocelli dark brown. Head is only slightly retractable beneath prothoracic segment.

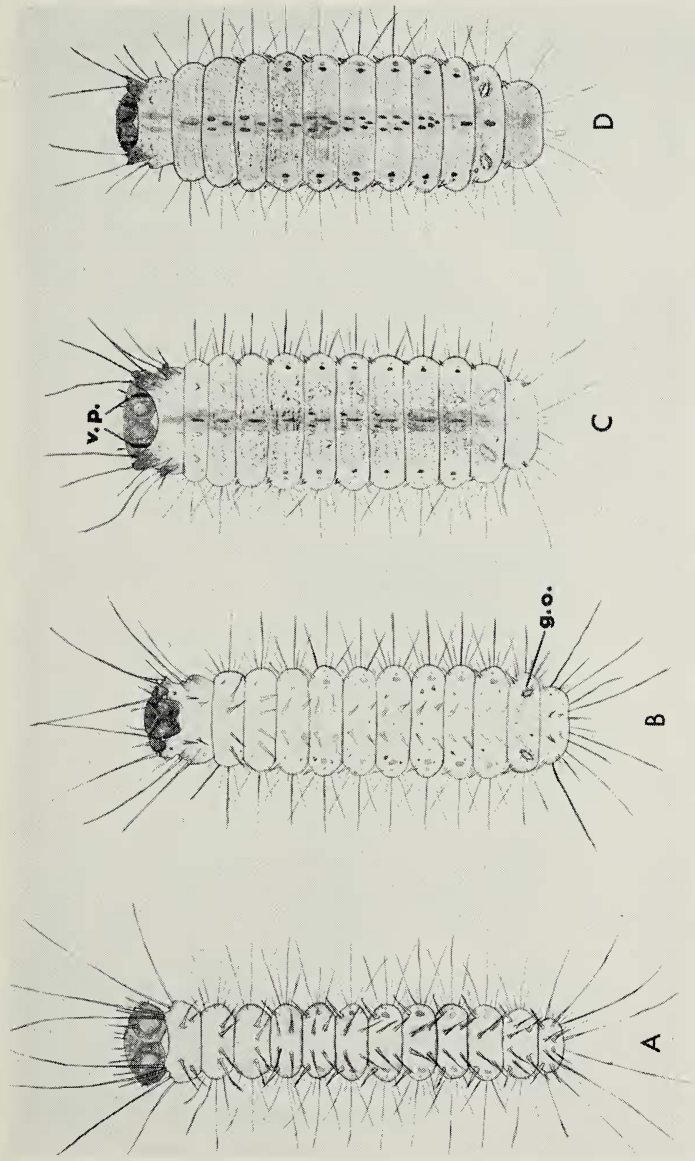

Fig. 1. A. First instar larva (39X). B. Second instar larva (15X); g.o.= gland orifice. C. Third instar larva (8X); v.p.=vibratory papilla. D. Fourth instar larva (5X).

Body dorso-ventrally compressed and extended laterally as before. Three thoracic segments expanding successively to the 0.7-0.8 mm. wide first abdominal segment (this type of arrangement continues throughout all instars and will not be mentioned hereafter). Prothoracic segment expanded dorso-anteriorly into two pairs of horn-like projections (one of which is more dorsal and larger than the other) that overhang the head slightly and that are whitish and tipped with dark brown markings; both pairs of horns composed of 2 small branches. Metathoracic segment of preserved larva shows a single pair of inconspicuous external slits set at a 45° angle to the middorsal line and situated on the posterior section of the lateral segmental expansion. Eighth abdominal segment slightly smaller than the preceding abdominal segments and with a pair of slight rectangular elevations set at a 45° angle to the middorsal line and situated slightly posterior to the spiracle (fig. 1B, g.o.). (I should mention here that these two pairs of structures, one on the metathoracic segment and the other on the eighth abdominal segment, may be present in the first instar larvae. Microscopic examination of first instar larvae indicates that there is the possibility that these structures are present in that stage although the actual structures were not discernable.) Spiracles inconspicuous as before.

Primary setae in the same arrangement as before. Secondary setae on the prothoracic segment arranged in the following manner: 2 long (0.7-0.8 mm. in length), fine, serrate, and white arising from the dorsal-most horn (1 per branch of horn) and 2 shorter (0.3-0.4 mm. in length) arising from the ventral-most horn (1 per branch of horn). All other segments with secondary setae slightly more numerous than before.

Legs as before. Prolegs concolorous with the body and with the crochets arranged in a biordinal mesoseries; ventral prolegs each with a protuberance as before separating the 6 mesal crochets from the 6 lateral crochets (fig. 4B); anal prolegs each with a similar protuberance but only a mesal mesoseries of 8 crochets present (fig. 4H); prolegs each with 1 or 2 small, simple, white setae arising from the planta.

Body ground color light yellowish green. Middorsal, longitudinal band, approximately 0.2 mm. in width, more greenish than ground color; dark color of blood in heart visible through the cuticle giving the impression of a discontinuous middorsal stripe. Supraspiracular row of small dark brown dots on the second to the seventh abdominal segments now very conspicuous. A few short papillae and granulations, concolorous with body, scattered on all segments.

Ecdysis occurs on the silken mat mentioned earlier; the exuviae are never eaten. Occasionally the old leaf is abandoned after ecdysis and another leaf chosen as the new resting site for the subsequent stadium.

In regards to the above mentioned slits and elevations, it appears that they are rudiments of the lateral organs and the honey glands that will be described below.

THIRD INSTAR LARVA: Fig. 1C. (Measurements and duration are based on 12 specimens.) Beginning of stadium- length, 5.1-5.4 mm.; width, 1.0-1.2 mm.; head diameter, 0.77-0.78 mm. Termination of stadium- length, 7.0-7.9 mm.; width, 2.1-2.7 mm. Duration, 5-6 days.

Head as before.

Body shape as before. Prothoracic segment as before but horns now much more conspicuous; a pair of heavily sclerotized, chitonous (a chitosan sulfate test proved positive), dark brown, lance-like papillae approximately 0.2-0.3 mm. in length and henceforth termed "vibratory papillae," explanation given below (fig. 1C, v.p.; detail, fig. 5F); each papilla is socketed and is attached internally to a small tendon (fig. 5F, t); this tendon serves as the point of insertion for two muscles, one of which (fig. 5F, m_2) originates on the median section of the post occipital ridge of the head capsule and the other (fig. 5F, m_1) on the posterior margin of the prothoracic segment. Metathoracic segment with a pair of slits situated on the anterior part of the lateral segmental expansion; a small finger-like projection or organ tipped with a rosette of approximately 12 fine, trichose, white setae can be everted from each of these slits especially following tactile stimulation but often without any such prevocation. Eighth abdominal segment with a pair of fully developed secretory glands. Spiracles now evident as faint yellow dots.

Primary setae now appearing as stout, short papillae; subdorsal pair on the eighth abdominal segment are now incorporated into the papillae fringing the orifices of the secretory glands (see below). Secondary setae more numerous than before; those on the dorsal-most pair of horns being 0.8-0.9 mm. in length (fig. 4N), the others being slightly shorter. Setal maps (fig. 5B) illustrate the arrangement of setae.

Legs as before. Prolegs concolorous with the body and with the crochets arranged in a biordinal mesoseries; ventral prolegs each with a protuberance as before separating the 14 mesal crochets from the 6 lateral crochets (fig. 4C); anal prolegs each with a similar protuberance but only a mesal mesoseries of 22 crochets present (fig. 4I); prolegs each with 1 or 2 small, simple, white setae and approximately 2 or 3 small papillae arising from the planta.

Body ground color light green. Middorsal band approximately 0.4 mm. in width and more greenish than ground color: band with 3 very slight wrinkles, each wrinkle with tiny, dark brown papillae (papillae on the thoracic and penultimate segments not confined to these elevations but more or less merged forming small patches); middorsal band with 2 lateral, dark green stripes on the anterior sections of the third, fourth, and fifth abdominal segments. Supraspiracular row of black dots as before. Papillae and granulations on the lateral segmental expansions dark brown, otherwise whitish except on previously described wrinkles; numerous papillae fringing the orifices of the secretory glands.

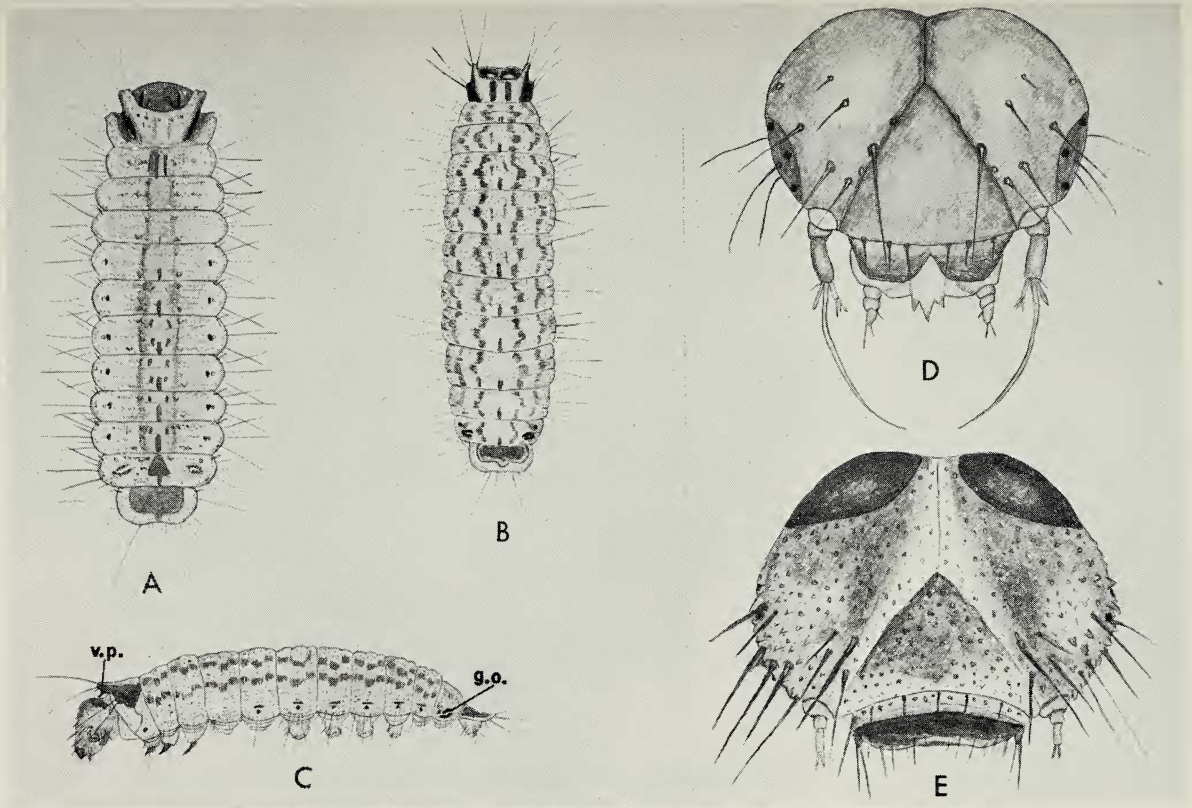

Fig. 2. A. Fifth instar larva (4X). B. Sixth instar larva (3X). C. Sixth instar larva, lateral view (3X); g.o.=gland orifice, v.p.=vibratory papillae. D. Head of first instar larva (200X). E. Head of sixth instar larva (20X).

The above mentioned "vibratory papillae" are so named because when a larva is disturbed, these structures vibrate very rapidly in an up and down manner. The relationship between the above mentioned secretory glands, tubercles, and these structures is not understood. The fact that they first appear in the same instar as that in which the glands and tubercles become functional (at least in this species as this correlation has not been made previously) would lead me to think that there may be a definite connection between the three. Bruch (1926) working with Hamearis epulus signatus Stich, an Argentine riodinid, states that the papillae must have some relationship with the secretory glands on the eighth abdominal segment. Bourquin (1953) states that in Hamearis susanae Orfila, another Argentine species, the attending ants (Camponotus punctulatus Mayr) frequently touch the vibrating structures and that this probably has some connection with the secretions produced from the glands on the eighth abdominal segment.

The above mentioned organs occurring on the metathoracic segment seem to be similar to the pair of lateral organs or tubercles which occur on the eighth abdominal segment of many of the Lycaenidae (see Clark and Dickson, 1956 and Hinton, 1951 for summaries). This is the first mention of any such structures occurring on a thoracic segment. See under SIXTH INSTAR LARVA for detailed morphological descriptions of these organs.

The above mentioned secretory glands on the eighth abdominal segment appear to be similar to the single honey gland of many of the Lycaenidae (see summaries by the above mentioned authors) and comparable to the pair of honey glands reported as occurring on the larvae of several of the Riodinidae: Theope eudocia Hew., T. foliorum Bates, and Nymphidium molpe Hub. (Guppy, 1904), Hamearis epulus signatus Stich. (Bruch, 1926) and H. susanae Orfila (Bourquin, 1953). See, also, under SIXTH INSTAR LARVA for detailed morphological descriptions of these organs. These honey glands secrete a clear, watery substance ("honey dew") which is sought by ants (Camponotus coruscus Fr. Smith and C. abdominalis Fabr.) As stated in the beginning, there is a very complex symbiotic relationship between the worker ants of the second mentioned species and the caterpillars of A. rossi, a subject which will be described in detail elsewhere.

From this instar on through the sixth, larvae are found at the bases of the crotons in tiny temporary burrows or "pens" constructed by the ants. The caterpillars spend the daylight hours in these confines but crawl out and up onto the leaves of the plants during the night in order to feed. As the larvae increase in size, they do not limit themselves to feeding from the inner portions of the leaves but instead, devour practically the entre leaves (excluding the veins).

FOURTH INSTAR LARVA: Fig. 1D. (Measurements and duration are based on 9 specimens). Beginning of stadium- length, 7.9-9.4 mm.; width, 2.2-3.1 mm.; head diameter, 1.10-1.16 mm. Termination of stadium- length, 10.1-11.0 mm.; width, 3.5-4.0 mm. Duration, 8-9 days.

Head dark brown with numerous fine, serrate, tan setae and papillae on lower portion.

Body shape as before. Prothoracic segment with horn-like projections now very conspicuous and bearing a remarkable resemblance to the Fifteenth Century Horn Dress; these structures project over the head such that from a dorsal view, the head of a resting individual is almost entirely obscured. Spiracles as before.

Primary setae as before; the subdorsal pair on the eighth abdominal segment is now indistinguishable from the numerous papillae fringing the orifices of the honey glands. Secondary setae are more numerous than before.

Legs as before. Prolegs concolorous with the ground color and with the crochets arranged in a triordinal mesoseries; ventral prolegs each with a protuberance as before separating the 26 mesal crochets from the 8 lateral crochets (fig. 4D); anal prolegs each with a similar protuberance but only a mesal mesoseries of 42 crochets present (fig. 4J); prolegs each with approximately 4 setae and approximately 6 or 7 small papillae arising from the planta.

Body ground color as before; faint yellow shading at the segmental junctures. Middorsal longitudinal band, approximately 1.0-1.2 mm. in width at the widest point but contracting slightly at the segmental junctures, slightly lighter than the ground color; band with wrinkles more evident and with papillae more numerous than before and with dark green markings: prothoracic segment with a single pair of lateral, rectangular stripes; meso- and metathoracic segments each with a single median, rectangular stripe (caused mainly by the circulating blood beneath the cuticle); first six abdominal segments each with a double pair of lateral dots and a single median dot, the five markings situated in a horse-shoe arrangement; seventh and eighth abdominal segments each with a single median, longitudinal stripe. (It should be mentioned here that some specimens exhibited slight variations from the above descriptions, e.g., some had the above described markings more or less fused, but generally the pattern was consistent). Supraspiracular row of dots as before. Papillae and granulations more numerous than before.

FIFTH INSTAR LARVA: Fig. 2A. (Measurements and duration are based on 8 specimens). Beginning of stadium- length, 12.0-13.4 mm.; width, 3.7-4.5 mm.; head diameter, 1.93-2.10 mm. Termination of stadium- length, 14.9-16.6 mm.; width, 4.1-4.9 mm. Duration, 23-25 days.

Head as before but with a light tan border near the epicranial suture. Setae finely trichose but not as trichose as those on the body. Papillae more numerous than before.

Body not as dorso-ventrally flattened as before. Eighth abdominal segment with glands bordered basally with 2 elevated, crescent-shaped, glossy black ridges. Spiracles as before.

Primary setae as before. Secondary setae more numerous than before and now finely trichose or pilose (fig. 4O); those on the prothoracic horns approximately 1.2-1.4 mm. in length, all others being slightly shorter.

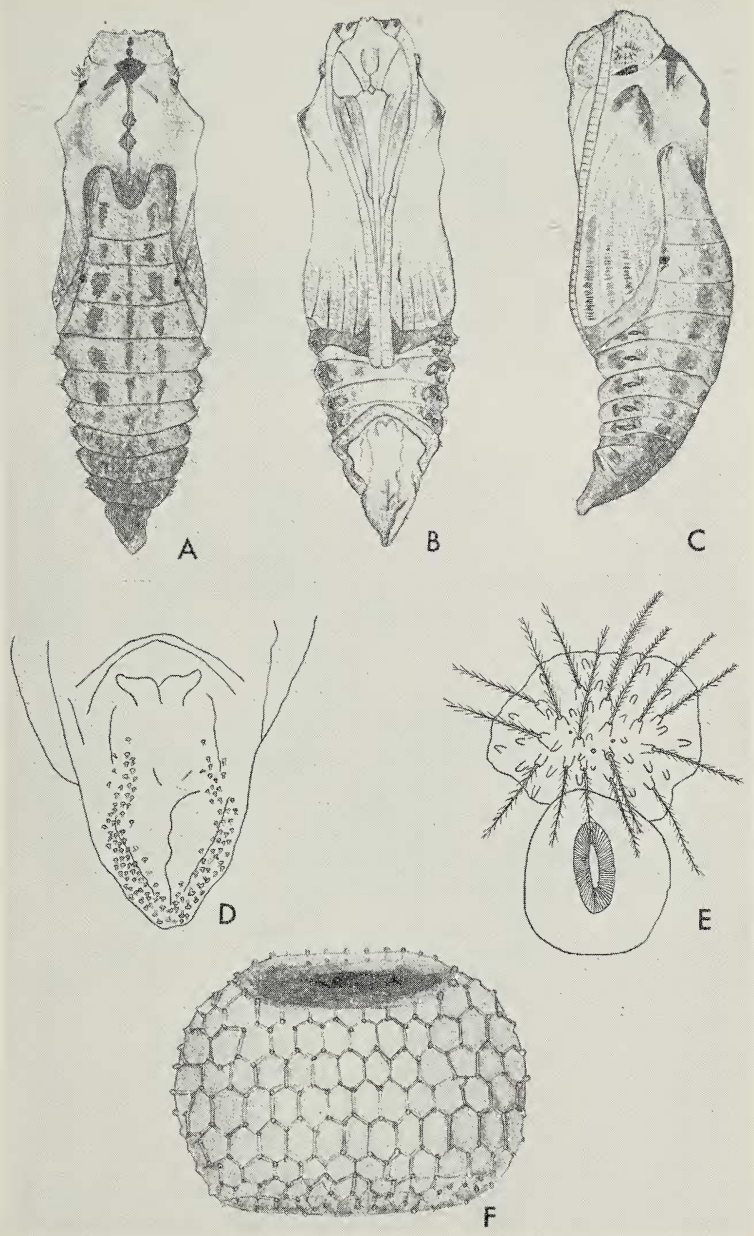

Fig. 3. A. Pupa, dorsal view (9X). B. Pupa, ventral view (9X). C. Pupa, lateral view (9X). D. Detail of cremaster of pupa (27X). E. Detail of pupal spiracle showing dorsal verruca (108X). F. Egg (75X).

Legs with claws now light brown. Prolegs concolorous with the ground color and with the crochets arranged in a triordinal mesoseries; ventral prolegs each with a protuberance as before separating the 38 mesal crochets from the 7 lateral crochets (fig. 4E); anal prolegs each with a similar protuberance but only a mesal mesoseries of approximately 50 crochets present (fig. 4L); prolegs each with approximately 4 setae and approximately 7 or 8 papillae arising from the planta.

Body ground color slightly darker than before; yellow shading at the segmental junctures now very evident. Dorsal part of the prothoracic segment slightly black. Middorsal longitudinal band now almost indistinguishable from the remainder of the body; "band" with markings (except the single, median, longitudinal stripes caused by the circulating blood on the third to the eighth abdominal segments) very faint and almost indiscernable. Supraspiracular row of black dots as before. Penultimate segment becoming totally dark green dorsally (except for a narrow paler margin) three days subsequent to the beginning of the stadium.

SIXTH INSTAR LARVA: Figs. 2B and C. (Measurements and duration are based on 4 specimens). Beginning of stadium- length, 15.0-16.3 mm.; width, 4.3-5.0 mm.; head diameter, 2.52-2.70 mm. Termination of stadium- length, 21.0-23.0 mm.; width, 5.0-6.1 mm. Duration, 26-29 days.

Head (fig. 2E) with the light border on the clypeus now light grey and more extensive than before; papillae more numerous than before and now on the entire head capsule.

Body shape less dorso-ventrally flattened than before. Eighth abdominal segment with the crescent-shaped ridges bordering the honey glands now more conspicuous. Spiracles more conspicuous than before.

The metathoracic lateral organs or tubercles consist of a finger-like invagination into the body wall. It appears as if these organs are of the basic lycaenid type described and illustrated by Ehrhardt (1914), Newcomer (1912), and Thomann (1901) in as much as they are invaginations of the cuticle and hypodermis. Figure 6B illustrates the structure of one of the organs. A thin cuticle (c) forms a lining to the retracted diverticulum, the opening of which in life, is covered with folds of the cuticle. The cuticle is modified at the basal one-fourth of the organ into approximately 12-14 trichose setae (s) that are completely concealed when the organ is in its contracted position; at the upper one-half of the organ into several "tactile papillae" (p) comparable to those scattered on the body surface; and at the lower one-half of the organ into numerous nipples (n). A single-celled layer of hypodermis (h) underlies the cuticle, the cells of which are small. These hypodermal cells under the papillae to which they are attached by thin, possibly neural, fibers, are large and pyriform. Numerous circular glandular structures (g) surround the lower-half of the organ beneath the hypodermis. The above mentioned nipples (n) are connected to these by means of fine ducts. A single retractor muscle (r. m.) inserts on the basal-most part of the organ and originates on the ventral body wall. Evagination of this organ is probably accomplished by an increase in the internal body pressure.

The "honey glands" consist of a complex of structures, several of which are different from those reported by Eltringham (1939), Erhardt (1914), Newcomer (1912), and Thomann (1901). Figure 6A illustrates the various structures and their relationships. A thin cuticle (c) forms a lining to the retracted eversible pouch (e. p.), the orifice of which is fringed by two crescent-shaped ridges bearing numerous papillae (p). The function of these papillae probably is to retain the "honey dew" and to keep it from flowing out and spreading over the surface of the body as is the case with the ant-attended aphids (Mordwilko, 1901). The orifice of this pouch in life is closed by folds of the pouch lining. A single-celled layer of hypodermis (h) underlies the cuticle, the cells of which are small. These hypoderal cells under the papillae to which they are attached by thin, possibly neural, fibers, are large and pyriform. A bladder (b) ventral to the eversible pouch that consists of a single layer of columnar epithelial cells. This may have the function of storing the "honey dew" which is probably manufactured in the gland (g) and transported to it through a small duct (d) composed of a single layer of cuboidal cells. A retractor muscle (r. m.) inserts at the base of the bladder and originates on the suprapedal lobe of the eighth abdominal segment. Evagination of the eversible pouch is probably accomplished by means of an increase in the internal body pressure.

Primary setae now very papillae-like and indistinguishable from the other body papillae. Secondary setae now very trichose (fig. 4P); the longest seta on the prothoracic horns approximately 1.4-1.6 mm. in length, all others being slightly shorter. Setal maps (fig. 5C) illustrate the arrangement of the setae.

Legs with claws now dark brown. Prolegs concolorous with the ground color and with the crochets arranged in a triordinal mesoseries; ventral prolegs each with a protuberance as before separating the 60-64 mesal crochets from the 7 lateral crochets (fig. 4F); anal prolegs each with a similar protuberance but only a mesal mesoseries of approximately 61-64 crochets present (fig. 4P); prolegs each with approximately 4 setae and approximately 7 or 8 papillae arising from the planta.

Body ground color slightly darker than before; the yellow shading at the segmental junctures is now more prominent and extensive. Dorsal area of the prothoracic segment now almost totally black. Middorsal, longitudinal band same color as before and indistinguishable except that it is bordered by irregular, longitudinal, brown markings forming a discontinuous subdorsal band; also, a discontinuous, ventral band of light brown markings present. Dorsal and lateral surfaces of cuticle with numerous small brown markings giving the body a mottled appearance. Supraspiracular

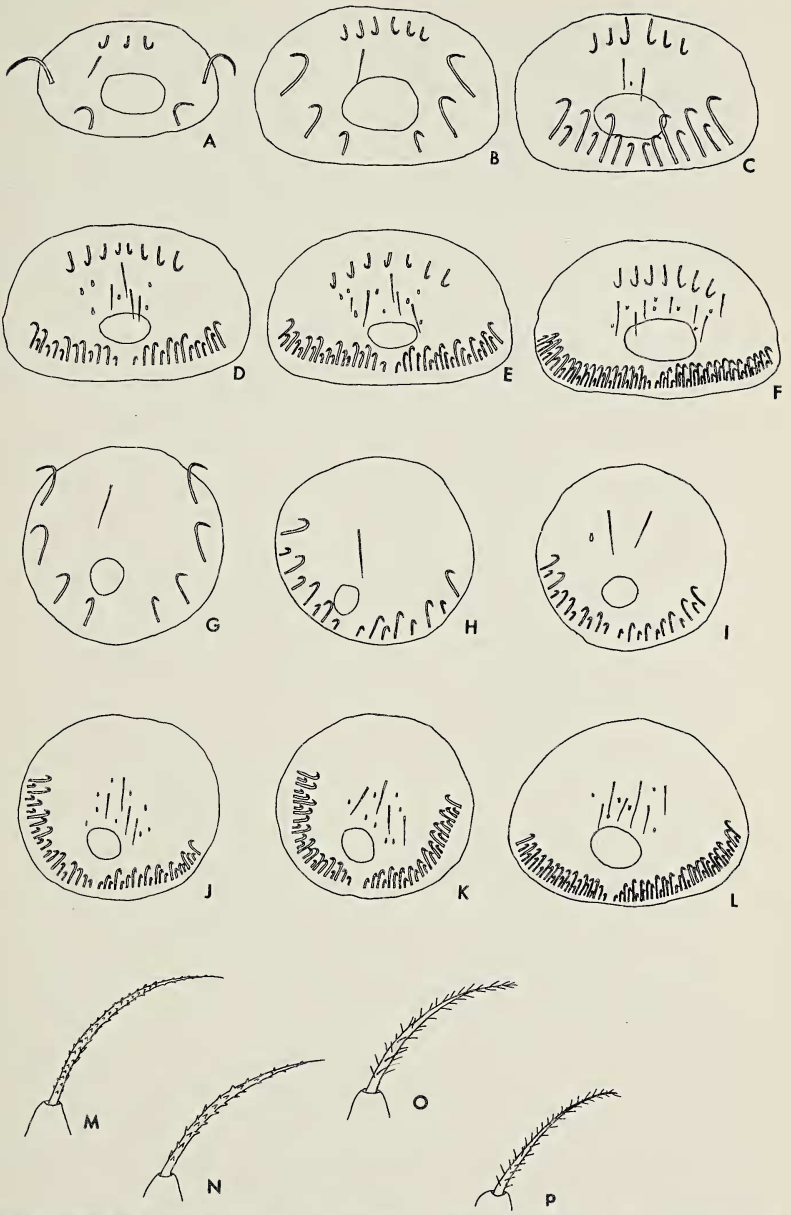

Fig. 4. A-F Ventral prolegs of larvae, measurements are approximate (A. First instar, 650X; B. Second instar, 260X; C. Third instar, 130X; D. Fourth instar, 55X; E. Fifth instar, 30X; F. Sixth instar, 25X). G-L Anal prolegs of larvae, measurements the same as those for the ventral prolegs (G. First instar; H. Second instar; I. Third instar; J. Fourth instar; K. Fifth instar; L. Sixth instar). M-P Setae of larvae (M. First instar, 30X; N. Third instar, 30X; O. Fifth instar, 22X; P. Sixth instar, 19X).

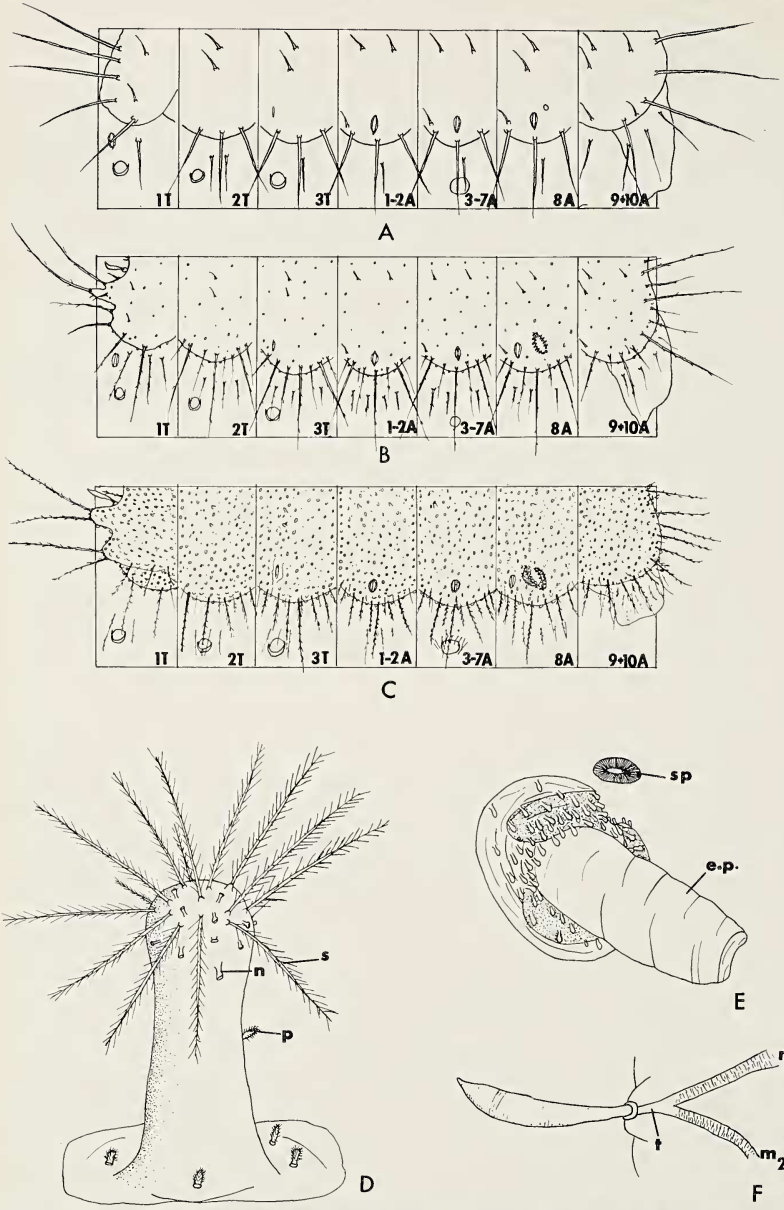

Fig. 5. A-C Setal maps of larvae (A. First instar; B. Third instar; C. sixth instar; T=thoracic segment, A=abdominal segment). D. Detail of everted lateral tubercle (53X); n=nipple, p=papilla, s=seta. E. Detail of everted "honey gland" (32X); e.p.=eversible pouch, sp=spiracle. F. Detail of "vibratory papilla" (58X); m_1=muscle originating on the posterior margin of the prothoracic segment, m_2=muscle originating on the post occipital ridge of the head capsule, t=tendon.

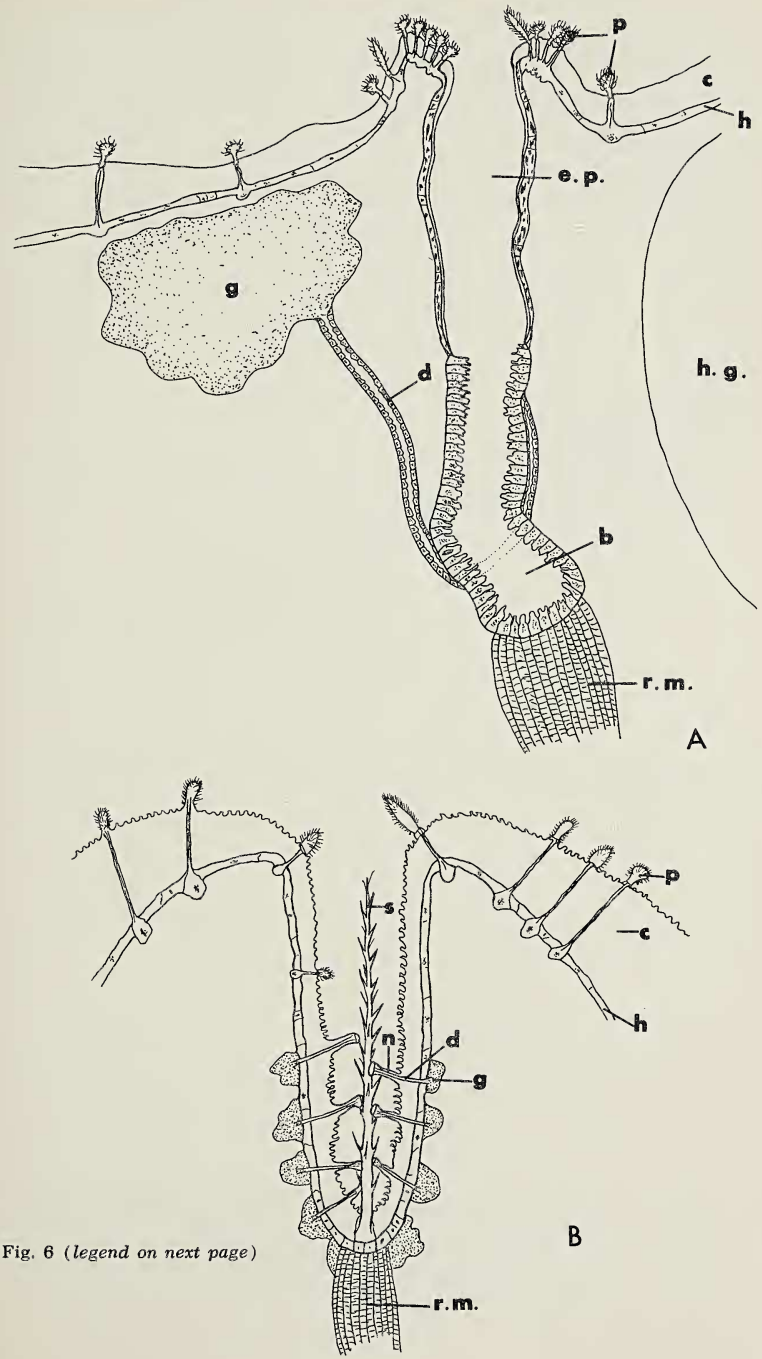

Fig. 6 (*legend on next page*)

row of dots as before. Papillae and granulations very abundant on all segments, predominately white but brownish on all brown cuticular markings. On the last two days of the stadium, the color fades to a pale yellowish green and practically all of the dark markings (except those on the horns and darkened area of the penultimate segment) disappear.

The secretory glands remain functional for the entire length of the stadium, even while the larva is hanging suspended from its support awaiting the period of pupation.

During the last two days of the stadium, the larva ceases feeding and remains constantly in its "pen." On the last day, the larva attaches the caudal segment, by means of silken threads, to the root or subterranean portion of the stem of the plant within the "pen."

It is interesting to note that the length of both the fifth and sixth instars appears to be exceedingly long (49-54 days total for both instars). Since these time durations are based on reared specimens in an artificial environment without ants, it is very possible that these stadia lengths may not be valid under natural conditions. Two facts lead me to conclude that my captivated larvae did not have a normal development: first, the observed head sizes of the sixth instar larvae are small as compared to the calculated head diameters (see table I); second, the food supply could hardly last the approximate 50 days for as stated under EGG, females oviposit on the rather small, "scrawny" plants. These plants did not possess enough foliage to support a caterpillar or two for that time duration. It may be that the tactile stimulation by the attending ants under natural conditions makes for a more rapid developmental period.

PUPA. Figs. 3A, B, C. (Measurements and duration are based on 12 specimens). Length, 14.0-16.3 mm.; maximum width, 4.8-5.9 mm. Duration, 11-13 days.

Head portion with eyes visible as brown blotches. Antennae extending slightly beyond wing margins. Proboscis slightly shorter than wing cases.

Thorax without any girdle. Metathoracic segment with a pair of glands in a position comparable to the lateral tubercles of the larva. Figure 7 illustrates one of the glands and the surrounding structures. A thin cuticle (c) with 3-5 nipples (n) overlies the gland (g). Each of these nipples has a small duct (d) leading from the nipple to the gland below. The gland lies in an exuvial space (e.s.) between the pupal cuticle and the newly-forming adult tissues, i.e., the cuticle (a.c.) and the basement membrane (b.m.).

Abdomen with a pair of scars in a position comparable to the pair of "honey glands" of the larva. Spiracles apparent; second through ninth pairs each with a small dorsal verruca bearing numerous small, trichose setae 0.1-0.2 mm. in length and numerous small papillae, some brown and some concolorous with the ground color (fig. 3E); also, a subspircular row of brown papillae and trichose setae. Abdominal segments terminating with the cremaster that appears as a ventrally flattened plate (fig. 3D). Dr. J.C. Downey (personal communication) informs me that the pupa has stridulatory organs between the fourth and fifth, and fifth and sixth abdominal tergites. These will be illustrated in one of his forthcoming papers.

Ground color light green (same color as that of the last instar larva) acquiring a slight yellowish tinge four days subsequent to the last larval molt and becoming dark brown two days prior to the adult's emergence. A narrow, discontinuous, middorsal, longitudinal, dark green band; also, numerous dark green-black blotches on the dorsal and lateral surfaces (the lower half of the abdomen is almost totally dark in color); very few markings ventrally except on the wing cases. Numerous tiny, light tan papillae (similar to those of the larva) covering all surfaces except the wing cases and the venter.

The above mentioned pupal glands are interesting in as much as this is the first time that any such glands have been observed. A couple of authors (Hinton, 1951; Roepke, 1918) state that several of the lycaenid pupae have what appear to be glandular openings on the seventh and/or eighth abdominal segments but in no case "has more than the presumed orifice of the resulting organ been described" (Hinton, 1951).

As stated earlier, pupation is in the "pen," the ants remaining in attendance for practically the entire duration of the pupal stage.

IMAGO: Adults are described and pictured by Clench (1964) in this same issue. The ecology and ethology of the butterflies will be discussed at a later date.

Fig. 6. A. Dorsal-ventral section through the region of a "honey gland" (53X); b=bladder, c=cuticle, d=duct, e.p.=eversible pouch, g=gland, h=hypodermis, h.g.=hind gut, p=papilla, r.m.=retractor muscle. B. Dorsal-ventral section through the region of a lateral tubercle (66X); c=cuticle, d=duct, g=gland, h=hypodermis, n=nipple, r.m.=retractor muscle.

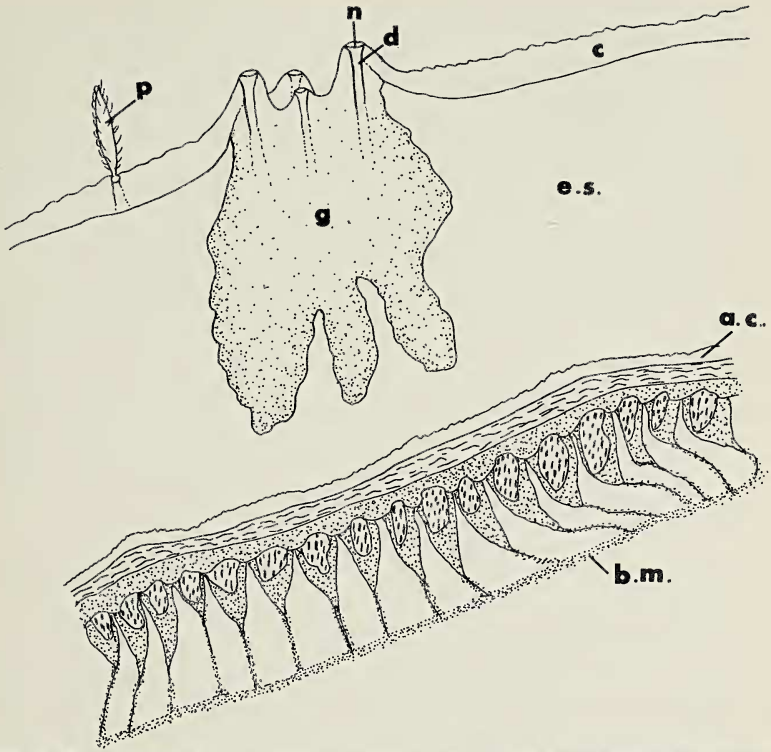

Fig. 7. Dorsal-ventral section through the region of a metathoracic, pupal gland (66X); a.c.=adult cuticle, b.m.=basement membrance, c=cuticle, d=duct, e.s.=exuvial space, g=gland, n=nipple, p=papilla.

TABLE 1

Observed and calculated head diameters based on Dyar's rule. Average figures were used in all calculations.

PERIOD (NO. OF INDIVIDUALS IN PARENTHESES)	OBSERVED HEAD DIAMETER (MM.) RANGE	MEAN	PER CENT INCREASE	CALCULATED HEAD DIAMETER (MM.)
First Instar Larva (15)	.32- .33	.32	----	----
Second Instar Larva (13)	.52- .53	.52	1.63	.49
Third Instar Larva (12)	.77- .78	.77	1.48	.80
Fourth Instar Larva (9)	1.10-1.16	1.13	1.47	1.18
Fifth Instar Larva (8)	1.93-2.10	2.01	1.78	1.73
Sixth Instar Larva (4)	2.52-2.70	2.61	1.30	3.08
Average			1.53	

they extended to me during my stay in Ocotal Chico, and their children—Mike, Cindy, Laura, and Juanita, for their assistance with the field work and their companionship during my stay; Dr. V. E. Rudd (U. S. National Museum, Smithsonian Institution, Washington, D. C.) for plant determinations; Dr. M. R. Smith (U.S.D.A., A.R.S., U. S. National Museum, Washington, D. C.) and Dr. E. O. Wilson (Harvard University, Cambridge, Massachusetts) for ant determinations; Mr. and Mrs. H. R. Hermann (Louisiana State University, Departments of Entomology and Zoology, respectively) for histological preparations; Dr. J. H. Roberts (L.S.U., Dept. of Zoology) for photographic assistance; Dr. J. C. Downey (Southern Illinois University, Carbondale, Illinois) for informing me of the presence of pupal stridulatory organs; Mr. H. K. Clench (Carnegie Museum, Pittsburgh, Pennsylvania) and Mr. S. L. Warter, Dr. M. S. Blum, and D. L. D. Newsom (L.S.U., Dept. of Entomology) for critisims and suggestions regarding the manuscript.

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